



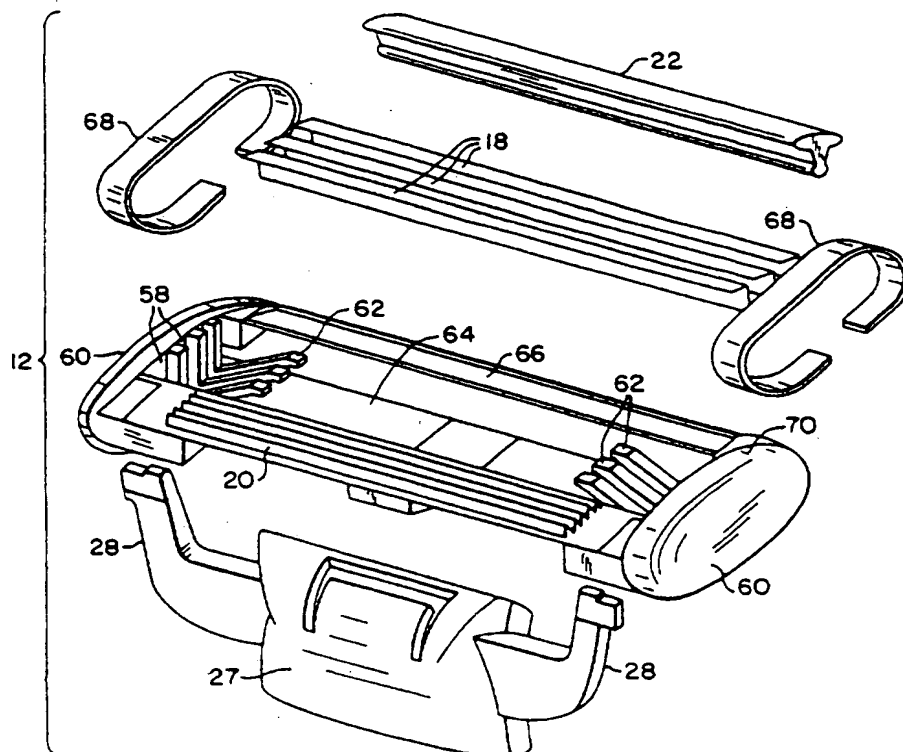
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>B26B 21/22, 21/52</b>		<b>A2</b>	(11) International Publication Number: <b>WO 97/37819</b>
			(43) International Publication Date: 16 October 1997 (16.10.97)
(21) International Application Number: PCT/US97/05697		02359 (US). WORRICK, Charles, Bridgham, III [US/US]; 586 Whitman Street, Hanson, MA 02341 (US).	
(22) International Filing Date: 8 April 1997 (08.04.97)		(74) Agents: GALLOWAY, Peter, D.; Ladas & Parry, 26 West 61st Street, New York, NY 10023 (US) et al.	
(30) Priority Data: 08/630,437 10 April 1996 (10.04.96) US		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).	
(60) Parent Application or Grant (63) Related by Continuation US 08/630,437 (CON) Filed on 10 April 1996 (10.04.96)			
(71) Applicant (for all designated States except US): THE GILLETTE COMPANY [US/US]; Prudential Tower Building, Boston, MA 02199-8004 (US).			
(72) Inventors; and			
(75) Inventors/Applicants (for US only): APPRILLE, Domenic, Vincent, Jr. [US/US]; 70 Decatur Street, Arlington, MA 02174 (US). CHAULK, Donald, Robert [US/US]; 3 Nest- ing Way, E. Sandwich, MA 02537 (US). FUCCI, Joseph, George [US/US]; 42 Tavern Wave, Hanson, MA 02341 (US). METCALF, Stephen, Cabot [US/US]; 16 Adella Av- enue, West Newtown, MA 02157 (US). TROTTA, Robert, Anthony [US/US]; 312 West Elm Street, Pembroke, MA			
Published Without international search report and to be republished upon receipt of that report.			

(54) Title: SHAVING SYSTEM AND METHOD

## (57) Abstract

A shaving system includes a replaceable shaving cartridge (14) and a shaving razor handle (12). The replaceable shaving cartridge (14) has a housing carrying (16) blades (18), a guard (20), a cap (22), and a camming surface. The cartridge includes an interconnect member (24) having a pivotal support structure that pivotally supports the housing (16) and a base structure (27) adapted to be removably and fixedly attached to the handle (12). A shaving razor handle (12) has an elongated hand gripping structure and a cartridge support structure extending from an end of the hand gripping structure. The cartridge support structure has an extension (26) with outer side surfaces that mate with inwardly directed surfaces of a recess (130) on the cartridge and an end surface with an opening. The extension has an asymmetrical shape to ensure proper orientation. A spring-biased plunger (41) is retained in the cartridge support structure and extends through the opening of the cartridge support structure.



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

### SHAVING SYSTEM AND METHOD

The invention relates to shaving systems having handles and replaceable cartridges.

Shaving systems often consist of a handle and a replaceable cartridge in which one or more blades are mounted in a plastic housing. After the blades in a cartridge have become dull from use, the cartridge is discarded, and replaced on the handle with a new cartridge. In some shaving systems the blades are resiliently mounted with respect to the cartridge housing and deflect under the force of skin contact during shaving. In some shaving systems the connection of the cartridge to the handle provides a pivotal mounting of the cartridge with respect to the handle so that the cartridge angle adjusts to follow the contours of the surface being shaved. In such systems, the cartridge can be biased toward an at rest position by the action of a spring-biased plunger (a cam follower) carried on the handle against a cam surface on the cartridge housing.

In general, in one aspect, the invention features a replaceable shaving cartridge having a housing carrying blades, a guard, a cap, and a camming surface. The cartridge also includes an interconnect member having a pivotal support structure that pivotally supports the housing and a base structure adapted to be removably and fixedly attached to a handle. The interconnect member provides access to the camming surface by a spring-biased cam follower on the handle.

In general, in another aspect, the invention features a replaceable shaving cartridge having a housing carrying blades, a guard, and a cap. The cartridge also includes an interconnect member having a pivotal support structure that pivotally supports the housing about a pivot axis and a base structure adapted to be removably and fixedly attached to an extension at an end of a handle. The handle extension has outer side surfaces, and the base structure has a recess with inwardly directed side surfaces that engage a sufficient number of the outer side surfaces on the handle extension so as to immovably position the base structure with respect to the handle extension. The base structure also has an opening to the recess along an axis that is nonparallel with respect to the pivot axis.

In general, in another aspect, the invention features a replaceable shaving cartridge having a housing carrying blades, a guard, and a cap. The cartridge also

- 2 -

includes an interconnect member having a base structure adapted to be removably and fixedly attached to a handle extension that extends from an end of a handle along an extension axis. The handle extension has outer side surfaces and an asymmetrical section in a plane through the side surfaces perpendicular to the extension axis. The base structure has a recess that mates with the extension and has inwardly directed side surfaces that engage a sufficient number of the outer side surfaces along the asymmetrical extension so as to immovably position the base with respect to the extension and to ensure proper orientation of the housing with respect to the handle. The base structure has an opening to the recess along an axis that is perpendicular to the plane.

In one aspect, the invention features, in general, a replaceable razor blade cartridge that includes a blade unit and cartridge connecting structure for connecting the blade unit to a handle. The cartridge connecting structure has inwardly directed surfaces that partially define a handle-receiving region and mate with outwardly directed surfaces on handle connecting structure of the handle. The cartridge connecting structure also has a connection entrance to the handle-receiving region and a projection that extends into the handle-receiving region. The projection has a blocking surface facing the opposite direction from the connection entrance to retain the handle connecting structure on the cartridge connecting structure.

In another aspect, the invention features, in general, a replaceable razor blade cartridge that includes a blade unit that is pivotally connected to a cartridge connecting structure that includes a latching member that is movable to release the cartridge from a handle.

Certain implementations of the invention include one or more of the following features.

In certain implementations: the housing has a substantially unobstructed rinsing region under the blades; the pivotal support structure has a pivot axis in front of the blades in the region of the guard. The shape of the recess in the base may be a trapezoid, have six sides and/or be flat in a direction parallel to the blades.

In certain implementations: the base structure is snap fitted onto the handle; the base structure has a detent and the handle has a mating depression adapted to receive the detent; alternatively the handle has a detent and the base structure has a

ating depression adapted to receive the detent; plural detents and depressions are used. Alternatively, the base structure is latchably secured to the handle.

In certain implementations: the housing and the interconnect member are made from separate pieces of plastic. Alternatively, the housing and the  
5 interconnect member are made of the same piece of plastic, and the pivotal support structure is provided by a living hinge. Alternatively, the pivotal support structure is provided by a flexible plastic hinge portion that is made of material that is more flexible than the housing and connects the housing and interconnect member at a pivot region.

10 In certain implementations: the pivotal support structure of the interconnect member includes two arms having ends retained in recesses with openings at two sides of the housing; the ends of the arms snap into the recesses of the housing; the recesses are covered by clips to retain the ends of the arms within the recesses; the arms have lower surfaces that slide on upwardly-directed arcuate surfaces on the  
15 housing.

In certain implementations: the housing has a camming surface for receiving a cam follower surface on a spring-biased plunger from the interconnect member; the interconnect member has an opening to receive the spring-biased plunger; the camming surface permits pivoting in only one direction from a rest position or  
20 permits different amounts of pivoting forward and backward from the rest position; the housing also has front and back stop surfaces that interact with the interconnect member.

In certain implementations: the blades are loaded into the housing from a top side of the housing; the blades are retained in the housing by clips that retain the  
25 interconnect member at a bottom side of the housing; the housing carries three blades; the blades are spring biased (e.g., the blades may be resiliently supported in the housing by spring arms integral with the housing; the guard is made of an elastomer and has flexible fins to engage the user's skin.

In general, in another aspect, the invention features a method of making  
30 a replaceable shaving cartridge. A housing for carrying blades, an interconnect member having a pivotal support structure and a base structure adapted to be removably and fixedly attached to a handle are provided. The pivotal support structure is inserted into

a recess in the housing. The pivotal support structure is retained in the recess.

Implementations of the invention may include one or more of the following features. The retaining step includes snap fitting and/or adding a clip. The blades may be added to the housing before adding a clip to retain the blades with the clip.

In general, in another aspect, the invention features a shaving razor handle having an elongated hand gripping structure and a cartridge support structure extending from an end of the hand gripping structure. The cartridge support structure has outer side surfaces that mate with inwardly directed surfaces of a recess on a cartridge and an end surface with an opening. A spring-biased plunger is retained in the cartridge support structure and extends through the opening of the cartridge support structured.

Certain implementations of the invention may include one or more of the following features.

In certain implementations: the outer side surfaces provide an asymmetrical shape to ensure proper orientation of the cartridge with respect to the handle; the spring-biased plunger is guided by a slot in the cartridge support structure; an ejector and snap fit ejector button are used to eject the cartridge; the ejector button has an inclined surface to facilitate attachment to the cartridge support structure; the ejector button slides on a guide surface in the cartridge support structure when pushing the ejector; the cartridge support structure has a track, and the ejector button has a groove that slides on the track.

In certain implementations: the plunger and the ejector are biased in opposite directions by a spring; the plunger has a stop which retains the plunger within the cartridge support structure; the plunger has an arm with an inclined surface, the inclined surface and the stop extending above the plunger and being retained in the slot in the cartridge support structure to guide the plunger; the stop has an inclined surface to permit the stop to be inserted into the cartridge support structure; the plunger has a rear guide member to further guide the plunger.

In certain implementations: the first end of the spring biases the plunger against the stop, and a second end of the spring biases the ejector against a back surface of the cartridge support structure; the ejector button and the cartridge support

- 5 -

structure have spring support portions to capture and guide the spring.

In certain implementations: the ejector is a U-shaped clip having ejector arms and narrower portions that engage the ejector button, and the cartridge support structure has a mating guide surface along which the ejector arms and the narrower portions slide.

In certain implementations: the cartridge support structure and the elongated gripping structure are made of a single piece of plastic. Alternatively, the cartridge support structure and the elongated gripping structure are made from separate pieces of plastic.

In general, in another aspect, the invention features a shaving razor handle having an elongated hand gripping structure and a cartridge support structure extending from an end of the hand gripping structure. The elongated hand gripping structure includes a gripping portion including an elastomeric plastic outer gripping layer and a nonelastomeric plastic support layer thereunder having extensions that are press-fitted into the elongated hand gripping structure.

In certain implementations: the elongated hand gripping structure is made of plastic and defines a recess in which a weight is disposed; the plastic is metallic-colored plastic.

In general, in another aspect, the invention features a method of making a shaving razor handle. An elongated hand gripping structure and an attached cartridge support structure extending from an end of the elongated hand gripping structure and having a recess therein with an inwardly directed stop surface are provided. A spring and a plunger having an outwardly directed stop surface are inserted into the recess until the outwardly directed stop surface passes the inwardly directed stop surface and is retained by the inwardly directed stop surface.

Certain implementations of the invention may include one or more of the following features: the ejector is inserted into the recess; an ejector button is inserted into the cartridge support structure to push the ejector.

In general, in another aspect, the invention features a razor including a handle and a replaceable shaving cartridge including a pivotal housing and an interconnect member. The housing carries blades, a guard, a cap, and has a camming surface. The interconnect member has a pivotal support structure that pivotally

- 6 -

supports the housing and a central base structure having a recess and an opening from the recess facing the camming surface. The handle has a cartridge support structure shaped to mate with the recess and a spring biased plunger with a cam follower surface extending from the cartridge support structure and through the opening to act on the camming surface to bias the housing.

In general, in another aspect, the invention features a razor having a replaceable shaving cartridge including a housing and an interconnect member. The housing carries at least one blade, a guard, and a cap. The interconnect member has a pivotal support structure and a central base structure with a recess. A handle has a cartridge support structure including an extension shaped to mate with the recess, and a stepped portion has the same shape as the central base structure so as to continue the shape from the cartridge support structure to the central base structure.

Certain implementations of the invention may include one or more of the following features: the central base structure may be flat along an axis that is parallel to the blade, and may also have a curved or beveled shape.

Other advantages and features of the invention will be apparent from the detailed description of preferred embodiments thereof and from the claims.

Fig. 1 is a perspective view of a shaving razor according to the invention.

Fig. 2 is a perspective view showing a handle and a replaceable cartridge of the Fig. 1 razor separated from each other.

Fig. 3 is an exploded view of the components of the Fig. 2 handle.

Fig. 3A is a diagrammatic sectional view, taken at 3A-3A of Fig. 2, of the Fig. 2 handle.

Fig. 4 is an exploded view of the components of the Fig. 2 replaceable cartridge.

Fig. 4A is an exploded sectional view, taken at 4A-4A of Fig. 14, of the components of the Fig. 2 replaceable cartridge.

Fig. 5 is a partial plan view showing a cartridge support structure at the end of the Fig. 2 handle.

Fig. 6 is an elevation of a plunger of the Fig. 2 handle.

Fig. 7 is a partial sectional view, taken at 7-7 of Fig. 5, of the Fig. 5



cartridge support structure.

Fig. 8 is a sectional view taken at 8-8 of Fig. 5, of the Fig. 5 cartridge support structure.

Fig. 9 is a partial sectional view, taken at 9-9 of Fig. 5, of the Fig. 5 cartridge support structure.

Fig. 10 is a plan view of an ejector used in the Fig. 5 cartridge support structure.

Fig. 11 is a perspective view of the Fig. 6 plunger.

Fig. 12 is an elevation of an ejector button used in the Fig. 5 cartridge support structure.

Fig. 13 is an elevation of the Fig. 2 replaceable cartridge.

Fig. 14 is a plan view of the Fig. 13 replaceable cartridge.

Fig. 15 is a bottom view of the Fig. 13 replaceable cartridge.

Fig. 16 is a side view, partially broken away, showing a housing of the Fig. 13 cartridge in an unbiased pivotal position with respect to a base structure of the cartridge prior to connection to a handle.

Fig. 17 is a side view, partially broken away, of the Fig. 13 cartridge in a biased position after connection to a handle.

Fig. 18 is a side view, partially broken away, showing the range of pivotal movement of the Fig. 13 replaceable cartridge.

Fig. 19 is a sectional view of an extension of the Fig. 2 handle.

Fig. 20 is a sectional view of an alternative embodiment of an extension of the Fig. 2 handle.

Figs. 21 and 22 are side views of alternative embodiments of cartridges having different pivotal support structures.

Referring to Figs. 1 and 2, shaving razor 10 includes handle 12 and replaceable shaving cartridge 14. As shown in Fig. 2, cartridge 14 is removable from handle 12. Cartridge 14 includes housing 16, which carries three blades 18, guard 20 and cap 22. Cartridge 14 also includes interconnect member 24 on which housing 16 is pivotally mounted. Interconnect member 24 includes base 27, which removably and fixedly attaches to asymmetrical extension 26 (Fig. 19) on handle 12, and two arms 28 that pivotally support housing 16 at its two sides.

- 8 -

Referring to Fig. 3, handle 12 includes metallic colored plastic component 30 as a primary structural member on which the remaining components are mounted. Elongated portion 32 of component 30 has recess 34 for receiving metal (e.g., zinc) weight 36, which is sandwiched between plastic gripping portions 38 and 40 to provide a hand-gripping structure in the completed unit. Plastic gripping portions 38 and 40 are made of an elastomeric plastic outer gripping layer 37 (e.g., thermoplastic elastomer) and a nonelastomeric plastic support layer 39 (e.g., of acrylonitrile butadiene styrene) thereunder made by two-color molding. The nonelastomeric plastic support layer has extensions 41 that are press-fitted into weight 36 in elongated portion 32. Fig. 3A illustrates the undeformed shape of extension 41 (in phantom) and the interference fit made by it at projection 43.

Cartridge support structure 42 extends from the end of elongated portion 32. It includes trapezoid shaped extension 26 (see Fig. 19) and the components that provide a spring-biased plunger action for biasing of housing 16 relative to interconnect member 24. It also includes components that provide for ejection of cartridge 14 from handle 12.

Spring-biased plunger 44, spring 46, and U-shaped ejector 48 are received within recess 49 of cartridge support structure 42. Ejector button 50 is received in opening 52 on the top surface of support structure 42 and has bottom extensions 54 that are received within rectangular region 56 at the back narrow portion of ejector 48.

Referring to Figs. 4, 4A and 15, housing 16 of cartridge 14 has inwardly facing slots 58 in side walls 60 for receiving the edges of the base portions 59 of blades 18 and respective resilient arms 62 (Fig. 15) on which each blade 18 is resiliently supported. Blades 18 are located in a substantially unobstructed region 64 between side walls 60 to provide for ease of rinsing of the cartridge during use.

Cap 22 provides a lubricous shaving aid and is received in slot 66 at the rear of housing 16. Cap 22 may be made of a material comprising a mixture of a hydrophobic material and a water leachable hydrophilic polymer material, as is known in the art and is described, e.g., in U.S. Patents Nos. 5,113,585 and 5,454,164, which are hereby incorporated by reference. Guard 20 includes a finned elastomeric unit mounted at the front of housing 16 to engage and stretch the user's skin; other skin

engaging protrusions, e.g., as described in U.S. Patent No. 5,191,712, which is hereby incorporated by reference, can be used. Clips 68 are secured at the respective sides of housing 16 inside of raised edges 70 of side walls 60 in order to retain blades 18 within housing 16 and to locate the cutting edges of the spring-biased blades at a  
5 desired exposure.

Clips 68 also wrap around the bottom of housing 16 and prevent the removal of pivotal support ends 72 of arms 28 of interconnect member 24. Base structure 27 has an opening 74 at the top through which spring-biased plunger 44 of the handle passes to act on a cam surface (not shown in Fig. 4) on the bottom of housing  
10 16. Base structure 27 may have a curved or beveled shape.

Figs. 5-12 and 19 show the details of plunger 44, ejector 48, button 50, and cartridge support structure 42. Referring to Fig. 5, recess 49 within cartridge support structure 42 has wide front portion 76 for receiving arms 78 of ejector 48 (Fig. 10) and a narrower portion 80 for receiving narrower portion 82 of ejector 48.  
15 Rectangular region 56 at narrow portion 82 of ejector 48 is generally aligned with opening 52 at the upper surface of support structure 42, though rectangular region 56 is movable with respect to opening 52 along slide axis 83 as ejector 48 is pushed outward by ejector button 50.

Referring to Figs. 8 and 12, each extension 54 of ejector button 50 has  
20 an outwardly directed groove 84 that slides on a respective track 86 within opening 52 along axis 83. The upper surfaces 85 defining grooves 84 slide on the upper surfaces 89 of tracks 86, and the lower surfaces 91 defining grooves 84 effect capture on or abut the lower surfaces 93 of track 86. Extensions 54 have inclined surfaces 87 that coact with the curved upper corners of tracks 86 to deflect extensions 54 inward as button 50  
25 is inserted into cartridge support structure 42. When grooves 84 on extension 54 align with tracks 86, extensions 54 substantially return to their undeflected position and lock ejector button 50 in place within opening 52. Ejector 48 is placed within recess 49 before button 50 is inserted so that the ends of extensions 54 will be located within rectangular region 56 so as to retain ejector 48 within cartridge support structure 42.  
30 Extensions 54 push against surfaces 94 of ejector 48 when ejector button 50 is pushed toward the end of handle 12. After button 50 has been inserted, upper vertical surfaces 96 of extensions 54 sit within the space between upper surfaces 98 of opening 52.

- 10 -

Spring 46 (Fig. 3) extends through the space between extensions 54 and is guided by the curved lower surface of spring guide 90 on button 50. As shown in Fig. 8, the lower surface defining recess 49 also has a curved central portion 92 to receive and guide spring 46.

5 As shown in Figs. 6 and 11, plunger 44 has flat body 106, cylindrical rear extension 100 for receiving spring 46 (Fig. 3), curved front cam follower portion 102 for acting on the camming surface 136 (Fig. 18) of housing 16, side arms 104, and aligned rear guide portions 108. Flat body 106 is positioned within the flat front portion of recess 49 (Fig. 6). The portions of side arms 104 and aligned rear guide  
10 portions 108 above and below body 106 are located within slots 110, 112 located on both sides of asymmetrical extension 26. Side arms 104 have stop surfaces 114 that prevent forward movement of plunger 44 beyond the front end of slot 110 and 112. The portions of side arms 104 and guide portions 108 above and below recess 49 within slots 110, 112 act as guides to guide the sliding action of plunger 44 along axis  
15 83.

Side arms 104 have inclined surfaces 120 to cause downward biasing of arms 104 when plunger 44 is inserted into recess 49 until stop surfaces 114 advance past the front ends of slots 110, 112 and stop surfaces 114 snap into position within the respective slot. Because slots 110, 112 are provided on both sides of asymmetrical  
20 extension 26, plunger 44 can be inserted in either position orientation, with the stop surface 114 directed into slot 110 or 112.

Referring to Figs. 5 and 9, one surface of asymmetrical extension 26 includes depressions 122 for receiving detents within base structure 27 of cartridge 14 in order to retain cartridge 14 on extension 26.

25 In manufacture of handle 12, the hand gripping components are assembled by first inserting weight 36 into recess 34, and then press-fitting extensions 41 of components 38, 40 into aligned apertures in weight 36. Weight 36 and components 38, 40 are locked in place by the interference fit between extensions 41 and projections 43, and elastomeric layer 37 deforms to provide a seal between the side  
30 walls of elongated portion 32 of plastic component 30 and weight 36. (Fig. 3A shows the undeformed shapes of the components in phantom.)

In assembling the components of cartridge support structure 42 at the

- 11 -

end of handle 12, ejector 48 is first inserted into recess 49. Spring 46 and plunger 44 are then inserted. Inclined surfaces 120 of side arms 104 are biased during insertion toward the middle of the recess and then snap into slot 110 or 112 (depending on plunger orientation) locking plunger 44, spring 46, and ejector 48 in place in cartridge support structure 42. Spring 46 acts both to bias ejector 48 backward against the surfaces of recess 49 and button extensions 54 and to bias plunger 44 forward, stop surfaces 114 being biased against the forward edges of slot 110 or 112. Button 50 is inserted into opening 52 after ejector 48 has been inserted into position. Inclined surfaces 87 are biased inward by the curved upper portions of rails 86, and ejector button 50 is snapped into place with tracks 86 being located within grooves 84.

Figs. 13-18 show further details of replaceable cartridge 14 and its pivotal movement. Referring to Fig. 13, interconnect member 24 is shown assembled to housing 16 with pivotal support ends 72 retained by clips 68. It is seen that base structure 27 has a trapezoidal shaped recess 130 that has the same shape as extension 26 and mates with extension 26.

Referring to Fig. 15, housing 16, shown before the other cartridge components have been assembled on it, has recesses 132 in which the pivotal support ends 72 on the ends of arms 28 are received. Arms 28 deflect as support ends 72 are inserted through the openings to recesses 132 and then snap back to an undeflected orientation after ends 72 are within recesses 132 to retain ends 72 in place.

Referring to Figs. 4A and 9, detents 132 within recess 130 of base 27 mate with depressions 122 of asymmetrical extension 26. At the top of recess 130 is opening 74 which permits spring-biased plunger 44 to extend through base 27 and to interact with camming surface 136 on the bottom of housing 16.

Referring to Figs. 16-18, it is seen that each pivotal support end 72 has a lower curved surface 138 that slides on upper curved surface 140 of housing 16, providing a pivot axis at the center of a circle that includes surface 140. The pivot axis thus is in front of the blades in the region of guard 20. Fig. 16 shows housing 16 in an unbiased position in which pivotal support ends 72 support the front surface of guide wall 162. Fig. 17 shows the forwardly biased position for housing 16, in which case the forward surface of pivot support ends 72 are pushed up against a forward wall portion of housing 16. This is the at rest position for housing 16 prior to shaving. The

- 12 -

forwardly-biased at rest position is achieved by contouring camming surface 136 so that the plunger 44 having cam follower surface 102 has an at rest position near the front of housing 16, as shown in Fig. 18.

Fig. 18 shows the range of pivotal motion for housing 16. During shaving, cap 22 will initially contact the user's skin, and housing 16 will pivot clockwise and generally follow the contours of the user's face, being biased by plunger 44. The cap up initial orientation will cause the blade closer to cap 22 to initially be pushed against the skin more than the blades closer to the guard. However, the pivot at the region of guard and the light return force cause the cartridge to be "guard heavy" during shaving, with a higher load on the guard than the cap. The three blades are provided with progressive initial exposures, defined as the perpendicular distance or height of the blade edge measured with respect to a plane tangential to the skin contacting surfaces of the cartridge components immediately in front of and behind each blade. In particular, the primary blade has a negative initial exposure, the second blade has zero initial exposure, and the third blade has positive initial exposure. The spring constants and preloads for the blades are the same, and the blades have "progressive force" distribution during shaving; i.e., the force on the third blade is greater than the force on the first blade, and the force on the second blade is intermediate to the forces on the first and third blades or equal to the force on either the first or third blade. It is believed that beneficial shaving results are achieved when cartridges with three resiliently mounted blades exhibit, during shaving, such a progressive force pattern.

Other embodiments of the invention are within the scope of the appended claims. The base structure could be held on the housing with a releasable latch. The blades could be loaded from the bottom instead of the top. The cartridge support structure could be made as a unit separate from the handle and attached to it. In place of trapezoidal extension 26 (Fig. 19), a six-sided extension 226 (Fig. 20), or other asymmetrical shape could be employed.

The pivotal connection could be provided by pins in respective holes, shell bearings, and other techniques. E.g., referring to Fig. 21, the pivotal support structure could be provided by a flexible plastic hinge portion 200 that is made of material that is more flexible than the housing 202 and connects the housing 202 and

- 13 -

interconnect member 204 at a pivot region 206; these components could be made by two-color molding. Alternatively, referring to Fig. 22, the housing 208 and the interconnect member 210 may be made of the same piece of plastic, and the pivotal support structure may be provided by a living hinge 212. A living hinge could also be  
5 used with housings and interconnect members of different plastics.

C L A I M S

1. A replaceable shaving cartridge comprising  
a housing carrying one or more blades, a guard, a cap, and a camming  
surface, and  
5 an interconnect member having a pivotal support structure that  
unbiasedly pivotally supports said housing and a base structure adapted to be removably  
and fixedly attached to a handle, said interconnect member providing access to said  
camming surface by a spring-biased cam follower on said handle.
2. A replaceable shaving cartridge comprising  
10 a housing carrying one or more blades, a guard, and a cap, and  
an interconnect member having a pivotal support structure that pivotally  
supports said housing about a pivot axis and a base structure adapted to be removable  
and fixedly attached to an extension at an end of a handle, said extension having outer  
side surfaces, said base structure having a recess with inwardly directed side surfaces  
15 that engage a sufficient number of said outer side surfaces so as to immovably position  
said base with respect to said extension, said base structure having an opening to said  
recess along a recess axis that is nonparallel with respect to said pivot axis.
3. The replaceable shaving cartridge of claim 1 or 2, wherein said housing  
has a substantially unobstructed rising region under said blades.
- 20 4. The replaceable shaving cartridge of claim 1, wherein said camming  
surface permits said housing to pivot in only one direction from an at rest position.
5. The replaceable shaving cartridge of claim 1 or 2, wherein said pivotal  
support structure has a pivot axis in front of said blades in the region of said guard.
6. The replaceable shaving cartridge of claim 1, wherein said base structure  
25 is adapted to be attached to an extension at an end of a handle, said extension having  
outer side surfaces, said base structure having a recess with inwardly directed side  
surfaces that engage a sufficient number of said outer side surfaces so as to immovably  
position said base with respect to said extension, said base structure having an opening  
to said recess along a recess axis that is nonparallel with respect to said pivot axis.
- 30 7. The replaceable shaving cartridge of claim 2 or 6, wherein said inwardly  
directed side surfaces immovably position said base with respect to said housing along  
two orthogonal axes that are perpendicular to said recess axis.



- 15 -

8. The replaceable shaving cartridge of claim 2 or 6, wherein said extension mates with said recess of said base via insertion along said recess axis.
9. The replaceable shaving cartridge of claim 2 or 6, wherein said recess has an asymmetrical shape to ensure proper orientation of said housing with respect to  
5 said handle.
10. The replaceable shaving cartridge of claim 2 or 6, wherein said outer side surfaces define a substantially trapezoidal shape, and said inwardly directed side surfaces of said recess are sufficient to ensure proper orientation of said housing with respect to said handle.
- 10 11. The replaceable shaving cartridge of 2 or 6, wherein said recess has an asymmetrical shape to ensure proper orientation of said housing with respect to said handle, and wherein said shape is substantially trapezoidal.
12. The replaceable shaving cartridge of claim 2 or 6, wherein said recess has an asymmetrical shape to ensure proper orientation of said housing with respect to  
15 said handle, and wherein said shape has six sides.
13. The replaceable shaving cartridge of claim 2 or 6, wherein said recess has a flat shape in a direction parallel to said blades.
14. The replaceable shaving cartridge of claim 1 or 2, wherein said base structure is snap fitted onto said handle.
- 20 15. The replaceable shaving cartridge of claim 2 or 6, wherein said base structure has a detent, and said handle has a mating depression adapted to receive said detent.
16. The replaceable shaving cartridge of claim 2 or 6, wherein said handle has a detent and said base structure has a mating depression adapted to receive said  
25 detent.
17. The replaceable shaving cartridge of claim 1 or 2, wherein said base structure is latchably secured to said handle.
18. The replaceable shaving cartridge of claim 1 or 2, wherein said housing and said interconnect member are made from separate pieces of plastic.
- 30 19. The replaceable shaving cartridge of claim 1 or 2, wherein said housing and said interconnect member are made of the same piece of plastic, and said pivotal support structure is provided by a living hinge.

20. The replaceable shaving cartridge of claim 1 or 2, wherein said pivotal support structure is provided by a flexible plastic hinge portion that is made of material that is more flexible than said housing and connects said housing and interconnect member at a pivot region.

5 21. The replaceable shaving cartridge of claim 1 or 2, wherein said pivotal support structure of said interconnect member includes two arms having ends retained in recesses with openings at two sides of said housing.

22. The replaceable shaving cartridge of claim 1 or 2, wherein said pivotal support structure of said interconnect member includes two arms having ends retained  
10 in recesses with openings at two sides of said housing, and wherein said ends of said arms snap into said recesses of said housing.

23. The replaceable shaving cartridge of claim 1 or 2, wherein said pivotal support structure of said interconnect member includes two arms having ends retained in recesses with openings at two sides of said housing, and wherein said recesses are  
15 covered by clips to retain said ends of said arms within said recesses.

24. The replaceable shaving cartridge of claim 1 or 2, wherein said pivotal support structure of said interconnect member includes two arms having ends retained in recesses with openings at two sides of said housing, and wherein said ends of said arms have lower surfaces that slide on upwardly-directed arcuate surfaces on said  
20 housing.

25. The replaceable shaving cartridge of claim 1, wherein said interconnect member has an opening through which said spring-biased cam follower passes.

26. The replaceable shaving cartridge of claim 1, wherein said camming surface permits said housing to pivot from an at rest position to a greater extent in one  
25 direction than in another direction.

27. The replaceable shaving cartridge of claim 1 or 2, wherein said housing has front and back stop surfaces that interact with said interconnect member to limit pivoting of said housing.

28. The replaceable shaving cartridge of claim 1 or 2, wherein said blades  
30 are loaded into said housing from a top side of said housing.

29. The replaceable shaving cartridge of claim 1 or 2, wherein said blades are loaded into said housing from a top side of said housing, and wherein said blades

are retained in said housing by clips that retain said interconnect member at a bottom side of said housing.

30. The replaceable shaving cartridge of claim 1 or 2, wherein said housing carries three blades.

5 31. The replaceable shaving cartridge of claim 1, 2 or 5, wherein said blades are spring biased.

32. The replaceable shaving cartridge of claim 1, 2 or 5, wherein said blades are resiliently supported in said housing by spring arms that are integral with said housing.

10 33. The replaceable shaving cartridge of claim 1 or 2, wherein said guard is made of an elastomer.

34. The replaceable shaving cartridge of claim 1 or 2, wherein said cap is made of a lubricous shaving aid component.

35. The replaceable shaving cartridge of claim 1 or 2, wherein said pivotal  
15 support structure has a pivot axis in front of said blades in the region of said guard, wherein said housing carries three spring-biased blades, wherein said guard is made of an elastomer, and wherein said cap is made of a lubricous shaving aid component.

36. A replaceable shaving cartridge comprising  
a housing carrying one or more blades, a guard, and a cap, and  
20 an interconnect member that is connected to said housing and has a base structure adapted to be removably and fixedly attached to an extension that extends from an end of a handle along an extension axis, said extension having outer side surfaces and an asymmetrical section in a plane through said side surfaces perpendicular to said extension axis.

25 said base structure having a recess that mates with said extension and has inwardly directed side surfaces that engage a sufficient number of said outer side surfaces along said asymmetrical extension so as to immovably position said base with respect to said extension and to ensure proper orientation of said housing with respect to said handle, said base structure having an opening to said recess along a recess axis  
30 that is perpendicular to said plane.

37. The replaceable shaving cartridge of claim 36, wherein said recess is elongated along an axis parallel to said blades.

- 18 -

38. The replaceable shaving cartridge of claim 36, wherein said extension mates with said base structure via insertion along said recess axis.
39. The replaceable shaving cartridge of claim 36, wherein said asymmetrical section has a trapezoid shape.
- 5 40. The replaceable shaving cartridge of claim 36, wherein said asymmetrical section has a six-sided shape.
41. The replaceable shaving cartridge of claim 36, wherein said base structure is snap fitted onto said handle.
42. The replaceable shaving cartridge of claim 36, wherein said handle has a  
10 detent, and said base structure has a mating depression adapted to receive said detent.
43. The replaceable shaving cartridge of claim 36, wherein said base structure has a detent, and said handle has a mating depression adapted to receive said detent.
44. The replaceable shaving cartridge of claim 36, wherein said base  
15 structure has two detents, and said handle has two mating depressions adapted to receive said detents.
45. A method of making a replaceable shaving cartridge comprising  
providing a housing for carrying one or more blades and an interconnect member having a pivotal support structure and a base structure adapted to be  
20 removably and fixedly attached to a handle,  
inserting said pivotal support structure into a recess in said housing, and  
retaining said pivotal support structure in said recess.
46. The method of claim 45, wherein said retaining includes snap fitting.
47. The method of claim 45, wherein said retaining includes adding a clip.
- 25 48. The method of claim 47, further comprising adding said blades to said housing before said adding of said clip and retaining said blades with said clip.
49. A shaving razor handle comprising  
an elongated hand gripping structure, and  
a cartridge support structure extending from an end of said hand gripping  
30 structure,  
said cartridge support structure having outer side surfaces that mate with inwardly directed surfaces of a recess on a cartridge and an end surface with an

opening, and

a spring-biased plunger that has a cam follower surface, is retained in said cartridge support structure and extends through said opening of said cartridge support structure.

5 50. The shaving razor handle of claim 49, wherein said outer side surfaces provide a section with an asymmetrical shape to ensure proper orientation of said cartridge with respect to said handle.

51. The shaving razor handle of claim 50, wherein said shape is a trapezoid.

52. The shaving razor handle of claim 50, wherein said shape has six sides.

10 53. The shaving razor handle of claim 50, wherein said shape is flat.

54. The shaving razor handle of claim 49, wherein said handle is snap fitted onto said cartridge.

55. The shaving razor handle of claim 54, wherein said cartridge has a detent, and one of said outer side surfaces of said cartridge support structure has a mating depression adapted to receive said detent.

56. The shaving razor handle of claim 54, wherein one of said outer side surfaces of said cartridge support structure has a detent, and said cartridge has a mating depression adapted to receive said detent.

57. The shaving razor handle of claim 49, wherein said spring-biased plunger is guided by a slot in said cartridge support structure.

58. The shaving razor handle of claim 57, further comprising an ejector pushed by a snap fit ejector button.

59. The shaving razor handle of claim 58, wherein said ejector button has an inclined surface to permit said button to be connected to said cartridge support structure.

60. The shaving razor handle of claim 58, wherein said ejector button slides on a guide surface on said cartridge support structure to push said ejector.

61. The shaving razor handle of claim 60, wherein said cartridge support structure has a track, and said ejector button has a groove that slides on said track.

30 62. The shaving razor handle of claim 58, wherein said plunger and said ejector are biased in opposite directions by a spring.

63. The shaving razor handle of claim 62, wherein said plunger has a stop

which retains said plunger within said cartridge support structure.

64. The shaving razor handle of claim 63, wherein said plunger has an arm with an inclined surface, said inclined surface and said stop extending above said plunger and retained in said slot in said cartridge support structure to guide said plunger.

65. The shaving razor handle of claim 64, wherein said stop has an inclined surface to permit said stop to be inserted into said cartridge support structure.

66. The shaving razor handle of claim 64, wherein said plunger has a rear guide member to further guide said plunger.

10 67. The shaving razor handle of claim 62, wherein a first end of said spring biases said plunger against said stop and a second end of said spring biases said ejector against a back surface of said cartridge support structure.

68. The shaving razor handle of claim 67, wherein said ejector button and said cartridge support structure have spring support portions to capture and guide said second end of said spring.

69. The shaving razor handle of claim 58, wherein said ejector is a U-shaped clip having ejector arms with narrower portions that receive said ejector button, and said cartridge support structure has a mating guide surface along which said ejector arms and said narrower portions slide.

20 70. The shaving razor handle of claim 49, wherein said cartridge support structure and said elongated gripping structure are made of a single piece of plastic.

71. The shaving razor handle of claim 49, wherein said cartridge support structure and said elongated gripping structure are made from separate components that are secured to each other.

25 72. A shaving handle comprising  
an elongated hand gripping structure, and  
a cartridge support structure extending from an end of said hand gripping structure.

30 said elongated hand gripping structure including a gripping portion  
comprising an elastomeric plastic outer gripping layer and a nonelastomeric plastic support layer thereunder having extensions that are press-fitted into said elongated hand gripping structure.

- 21 -

73. The shaving razor handle of claim 72, wherein said elongated hand gripping structure is made of plastic and defines a recess, and further comprising a weight in said recess.

74. The shaving razor handle of claim 73, wherein said gripping portion is  
5 press fitted into said weight.

75. The shaving razor handle of claim 74, wherein there are plurality of gripping portions press fitted into said weight.

76. The shaving razor handle of claim 73, wherein said elongated hand gripping structure is made of metallic-colored plastic.

10 77. A method of making a shaving razor handle comprising  
providing an elongated hand gripping structure and an attached cartridge support structure extending from an end of said elongated hand gripping structure and having a recess therein with an inwardly directed stop surface, and  
inserting a spring and a plunger having a cam follower surface and an  
15 outwardly directed stop surface into said recess until said outwardly directed stop surface passes said inwardly directed stop surface and is retained by said inwardly directed stop surface.

78. The method of claim 77, further comprising inserting an ejector into said recess.

20 79. The method of claim 78, further comprising inserting an ejector button into said cartridge support structure to push said ejector.

80. The method of claim 79, further comprising providing a guide surface in said cartridge support structure on which said ejector button slides to push said ejector.

81. The method of claim 80, further comprising providing a track in said  
25 cartridge support structure and a groove on said ejector button so that said groove slides along said track.

82. The method of claim 79, wherein said ejector is a U-shaped clip having ejector arms with narrower portions that receive said ejector button, and said cartridge support structure has a mating guide surface along which said ejector arms and said  
30 narrower portions slide.

83. The method of claim 76, wherein said plunger and said ejector are biased in opposite directions by said spring.

- 22 -

84. The method of claim 78, wherein a first end of said spring biases said plunger against said stop and a second end of said spring biases said ejector against a back surface of said cartridge support structure.

5 85. The method of claim 78, wherein said plunger has an arm with an inclined surface, said inclined surface and said outwardly directed stop surface extending above said plunger and retained in said slot in said cartridge support structure to guide said plunger.

86. The method of claim 85, wherein said outwardly directed stop has an inclined surface to permit said outwardly directed stop to be inserted into said cartridge support structure.

10 87. The method of claim 85, wherein said plunger has a rear guide member to further guide said plunger.

88. A razor comprising  
a replaceable shaving cartridge including a pivotal housing and an  
15 interconnect member,  
said housing carrying one or more blades, a guard, and a cap, and having a camming surface,

said interconnect member having a pivotal support structure that pivotally supports said housing for pivoting about a pivot axis and a central base structure having a recess and an opening from said recess facing said camming surface,  
20 and

a handle having a cartridge support structure shaped to mate with said recess and a spring biased plunger that has a cam follower surface and extends from said cartridge support structure and through said opening to act on said camming surface to bias said housing.

25 89. The razor of claim 88, wherein said camming surface permits said housing to pivot in only one direction from an at rest position.

90. The razor of claim 88, wherein said pivotal support structure has a pivot axis in front of said blades in the region of said guard.

30 91. The razor of claim 88, wherein said cartridge support structure includes an extension at an end of a handle, said extension having outer side surfaces, said base structure recess has inwardly directed side surfaces that engage a sufficient number of



- 23 -

said outer side surfaces so as to immovably position said base structure with respect to said extension, said base structure having an opening to said recess along a recess axis that is nonparallel with respect to said pivot axis.

92. The razor of claim 88, wherein said recess has an asymmetrical shape to ensure proper orientation of said housing with respect to said handle, and wherein said shape is substantially trapezoidal.

93. The razor of claim 88, wherein said recess has an asymmetrical shape to ensure proper orientation of said housing with respect to said handle, and wherein said shape has six sides.

94. The razor of claim 88, wherein said recess has a flat shape in a direction parallel to said blades.

95. The razor of claim 88, wherein said handle has a detent, and said base structure has a mating depression adapted to receive said detent.

96. The razor of claim 88, wherein said pivotal support structure's pivot axis is located in front of said blades in the region of said guard, wherein said housing carries three spring-biased blades, wherein said guard is made of an elastomer, and wherein said cap is made of a lubricous shaving aid component.

97. The razor of claim 88, wherein said cartridge support structure has an ejector pushed by a snap fit ejector button.

98. A razor comprising  
a replaceable shaving cartridge including a housing and an interconnect member,

said housing carrying one or more blades, a guard, and a cap.

said interconnect member having a pivotal support structure that  
pivotaly supports said housing and a central base structure having a recess, and

a handle having a cartridge support structure including an extension shaped to mate with said recess, and a stepped portion having the same shape as said central base structure so as to continue the shape from said cartridge support structure to said central base structure.

99. The razor of claim 98, wherein the central base structure is flat along an axis that is parallel to the blade.

100. The razor of claim 98, wherein said shape of said cartridge base structure

is curved.

101. The razor of claim 98, wherein said shape of said cartridge base structure is beveled.

102. A replaceable razor blade cartridge comprising

5

a blade unit, and

cartridge connecting structure for connecting said blade unit to handle connecting structure of a handle,

said cartridge connecting structure having inwardly directed surfaces for mating with outwardly directed surfaces on said handle connecting structure,

10

said cartridge connecting structure having a handle-receiving region partially defined by said inwardly directed surfaces and a connection entrance to said handle-receiving region,

15

said cartridge connecting structure including a projection that extends into said handle-receiving region and has a blocking surface facing the opposite direction from said connection entrance to retain said handle connecting structure on said cartridge connecting structure.

103. A replaceable razor blade cartridge comprising a blade unit, and

20

cartridge connecting structure for connecting said blade unit to handle connecting structure of a handle, said blade unit being pivotally connected to said cartridge connecting structure,

said cartridge connecting structure including a latching member that is movable to release said cartridge from said handle connecting structure.

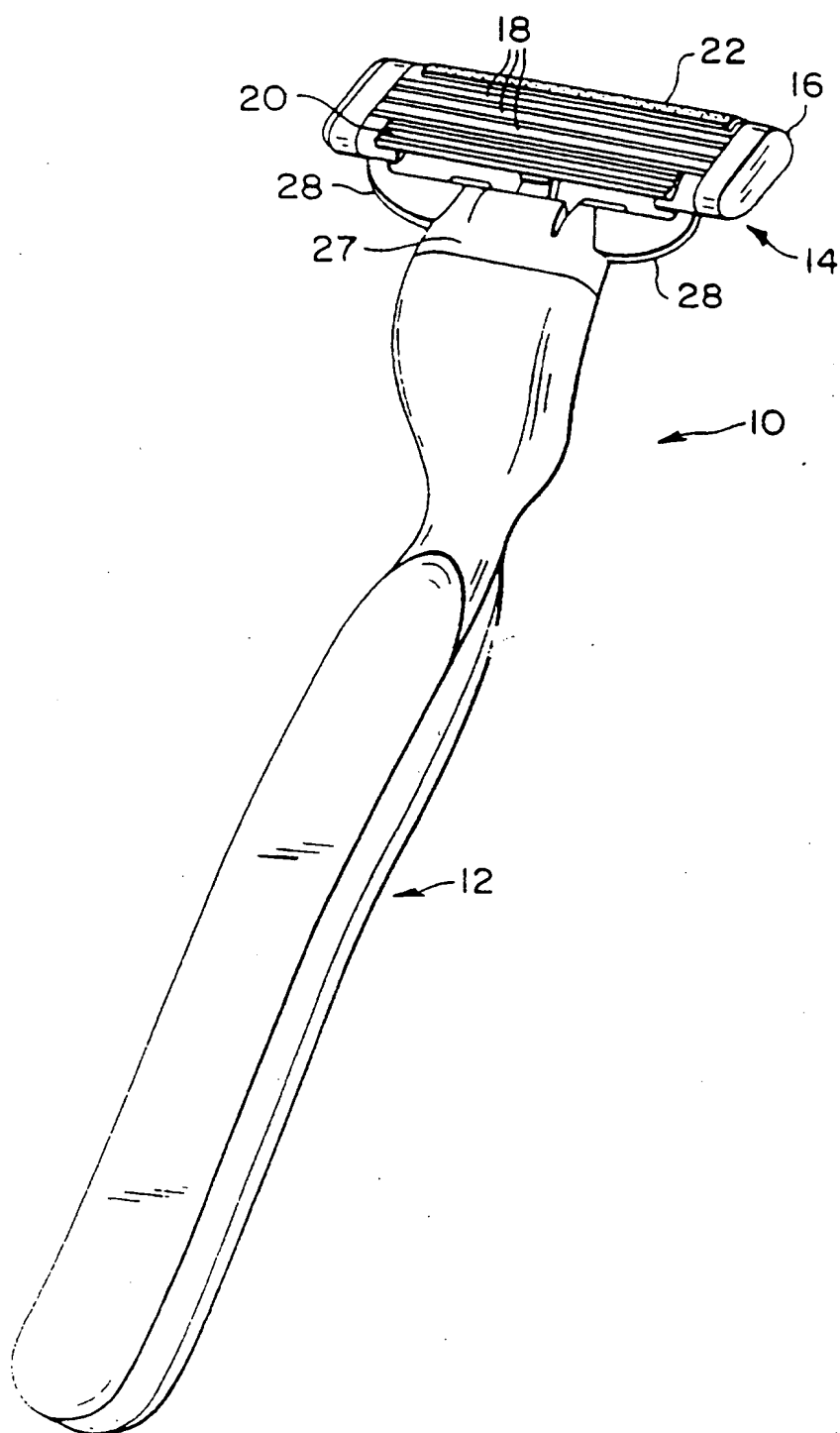
104. The cartridge of claim 1, wherein said blade unit is pivotally connected to said cartridge connecting structure.

25

105. The cartridge of claim 1, wherein said cartridge connecting structure has a connection axis passing through said connection axis and into said handle receiving region, and wherein a section through said inwardly directed surfaces in a plane transverse to said connection axis is asymmetrical.

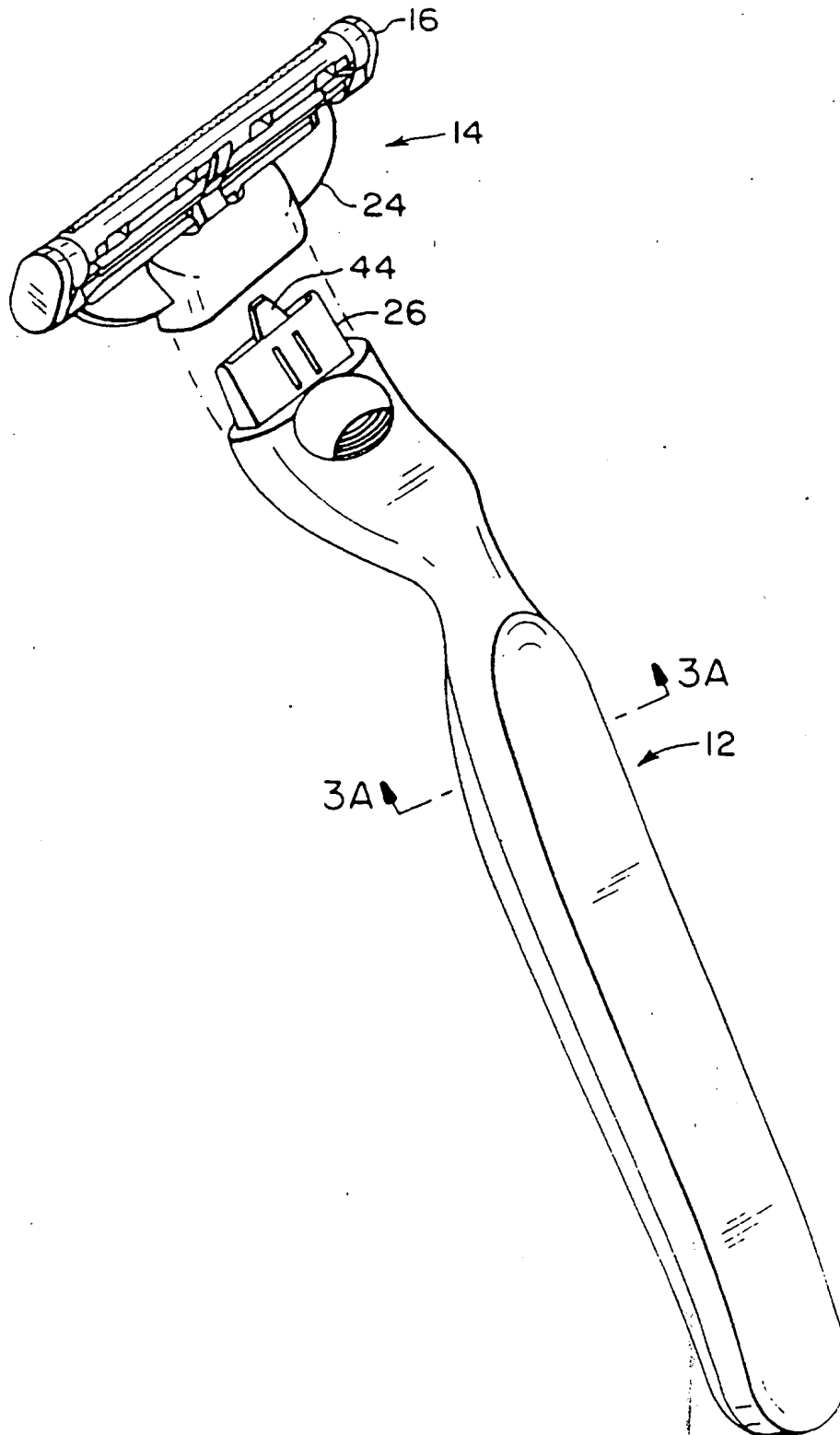
1 / 13

FIG. 1



2 / 13

FIG. 2



3 / 1 3

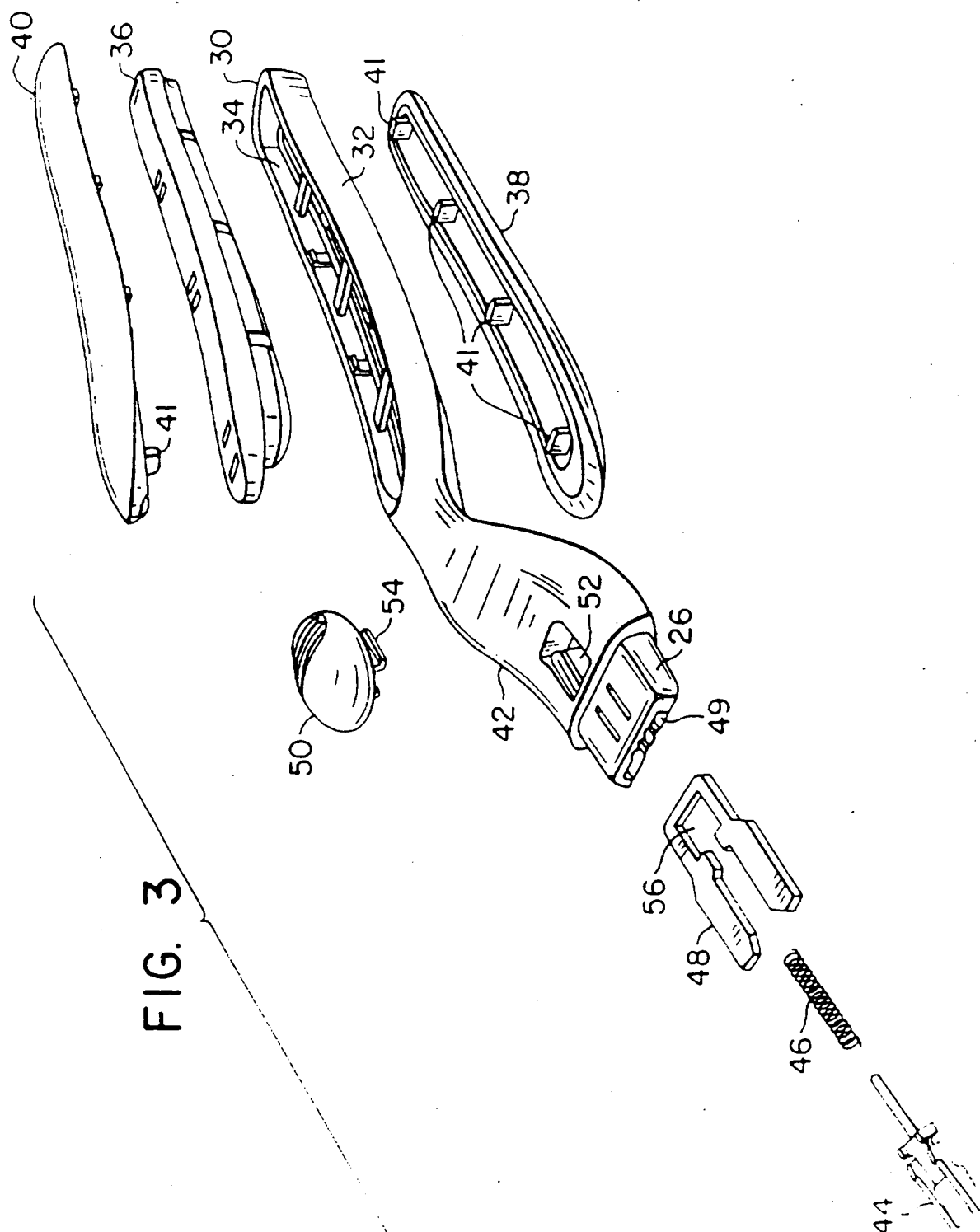
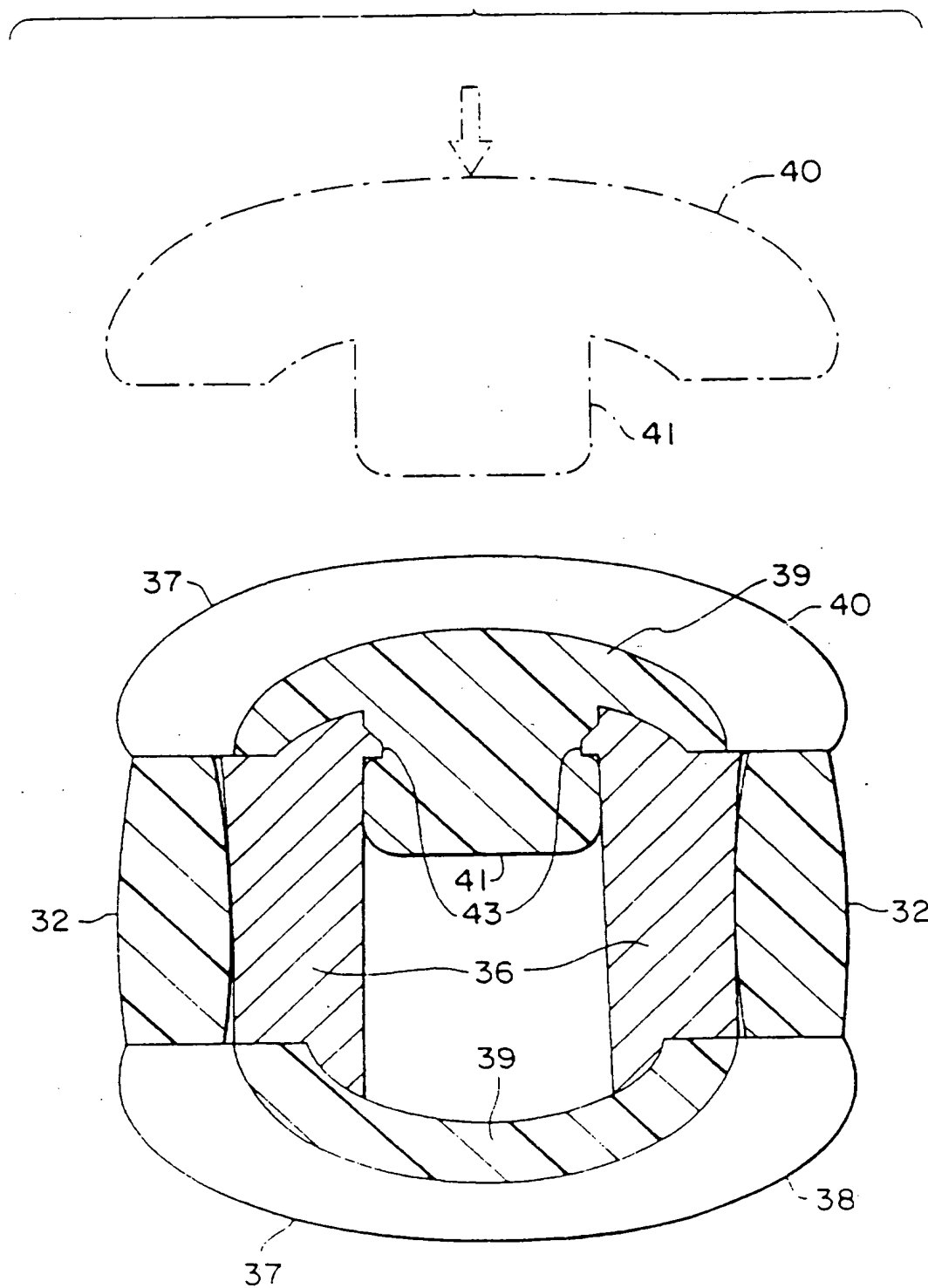


FIG. 3

4 / 1 3

FIG. 3A



5 / 13

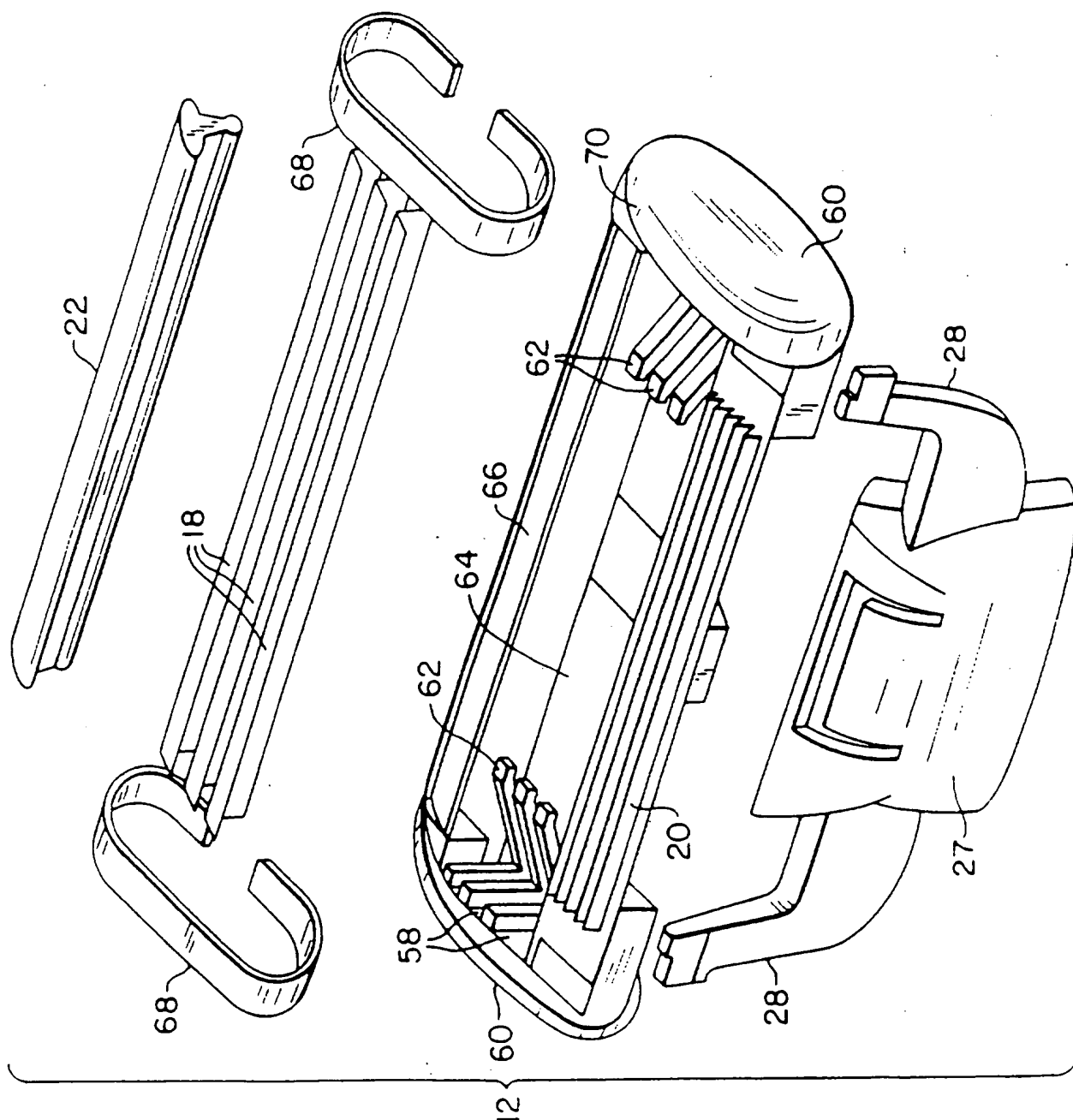
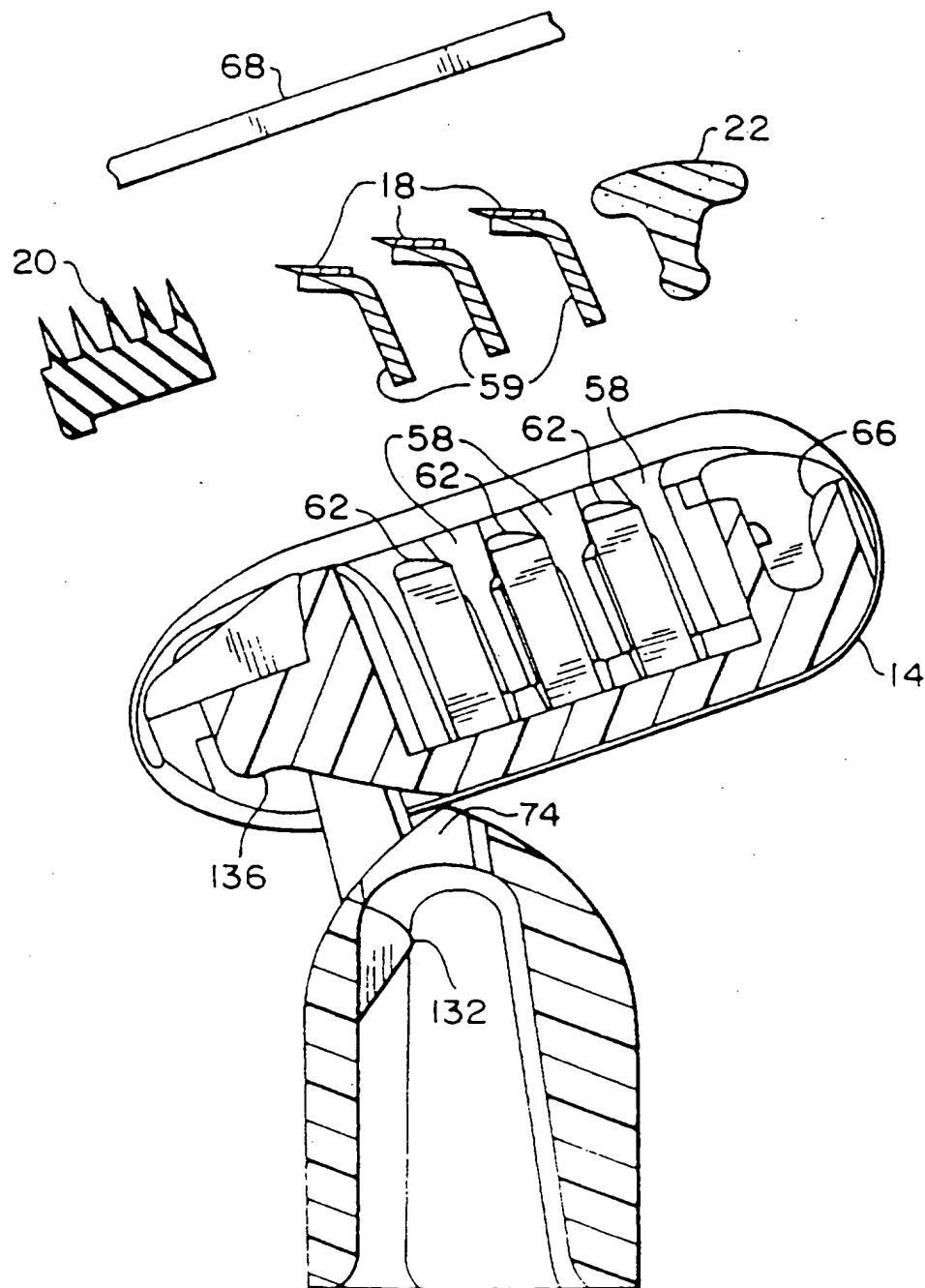


FIG. 4

6 / 13

FIG. 4A





7 / 13

FIG. 5

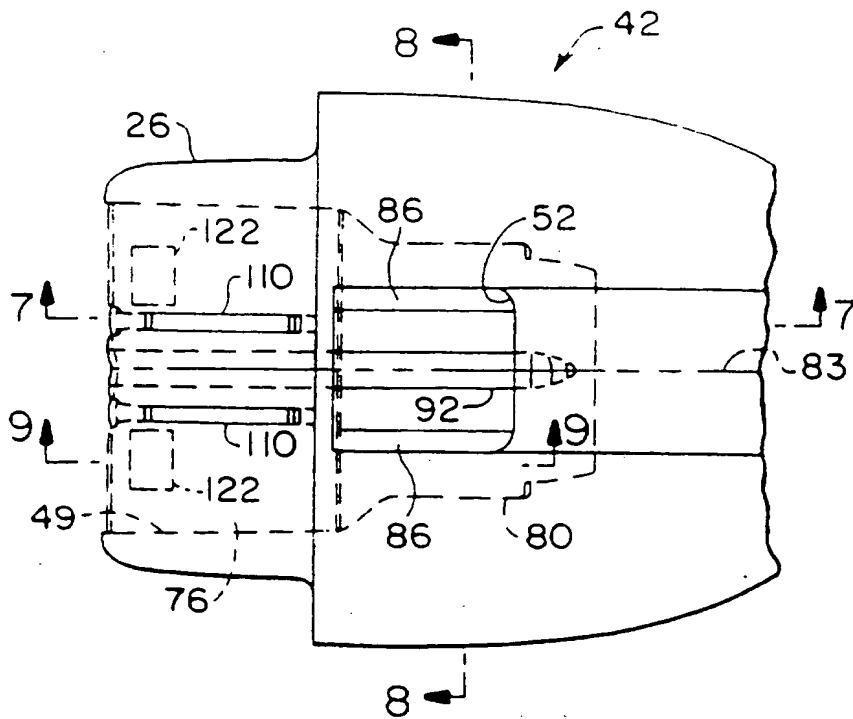


FIG. 6

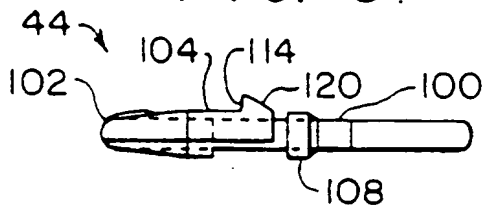


FIG. 7

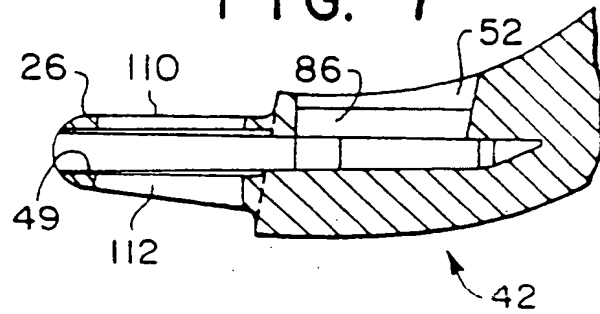


FIG. 8

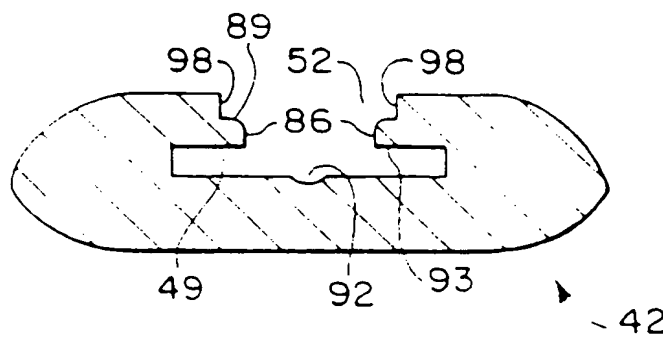


FIG. 9

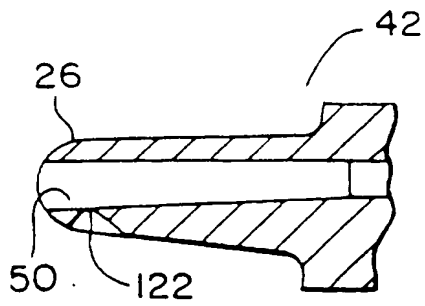


FIG. 10

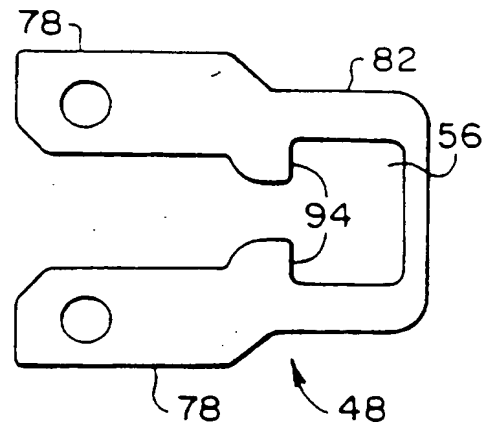


FIG. 11

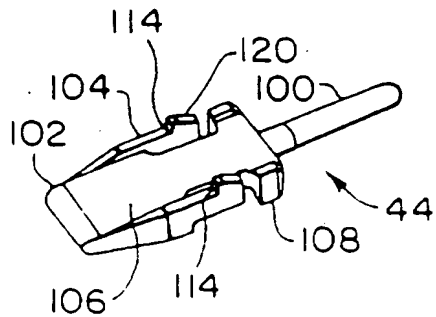
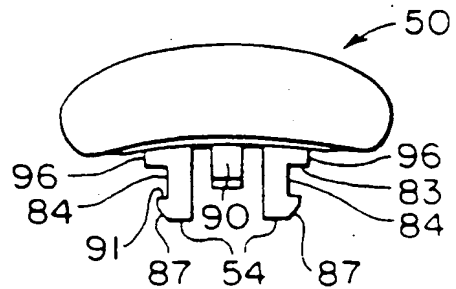
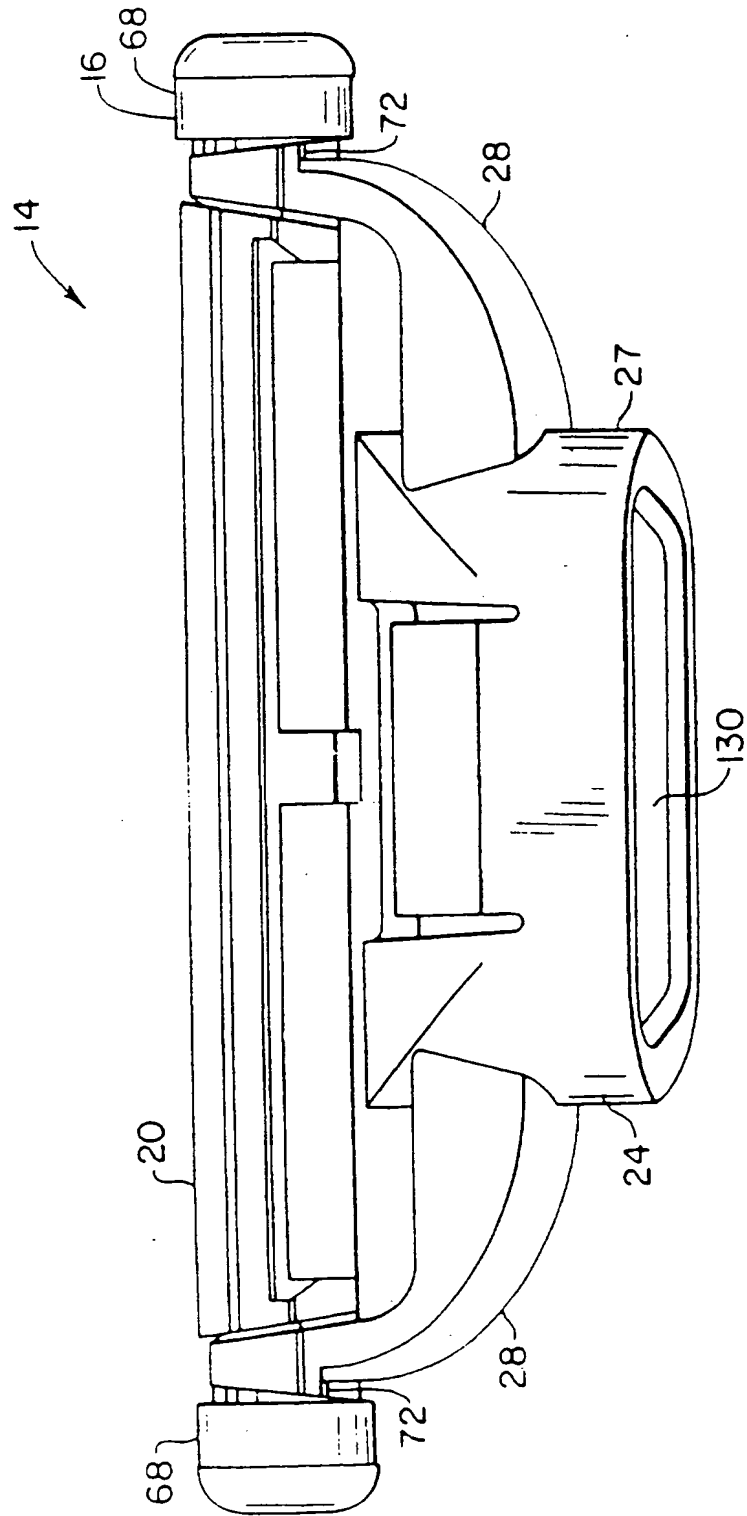


FIG. 12



9 / 13

FIG. 13



10 / 13

FIG. 14

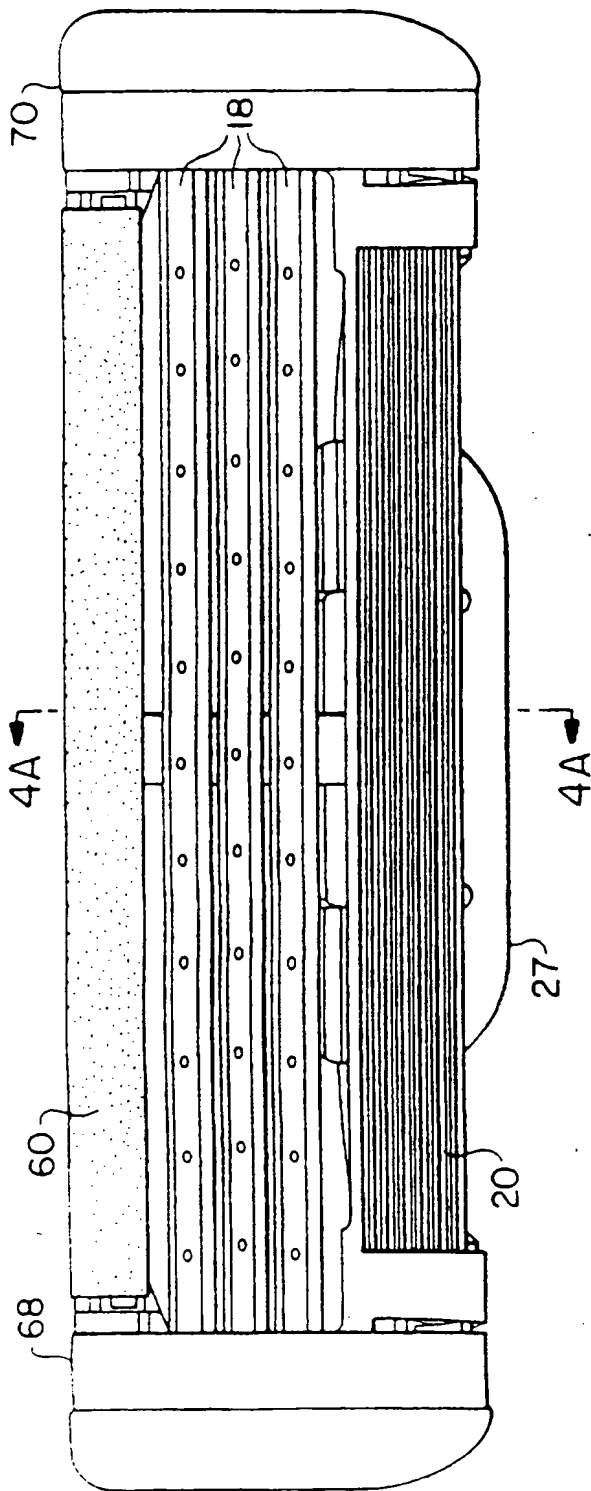
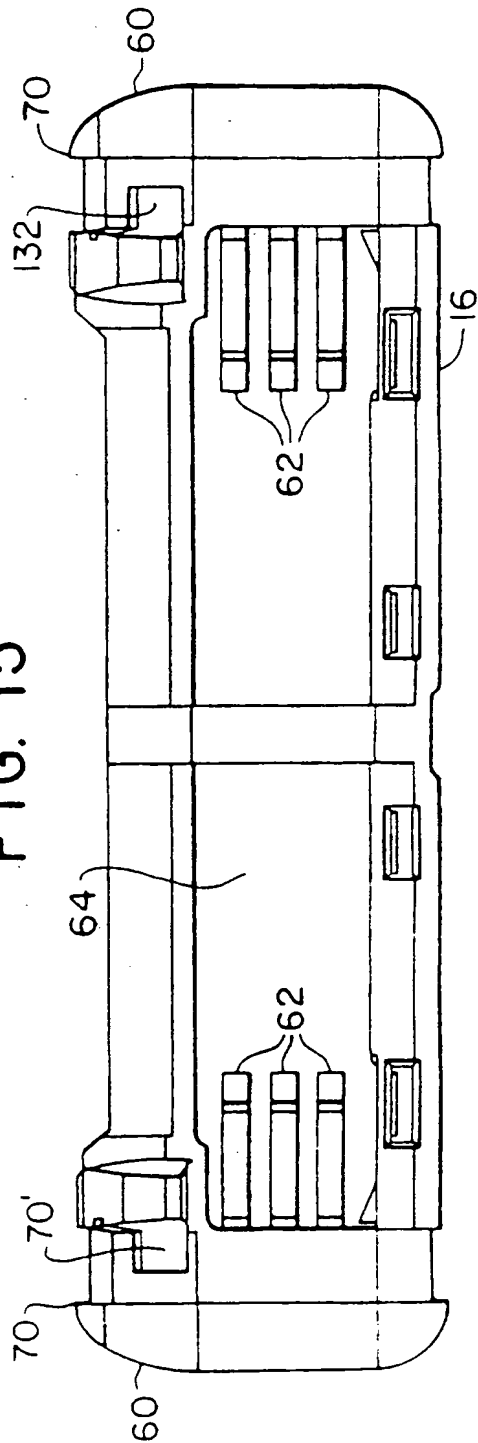


FIG. 15



11 / 13

FIG. 16

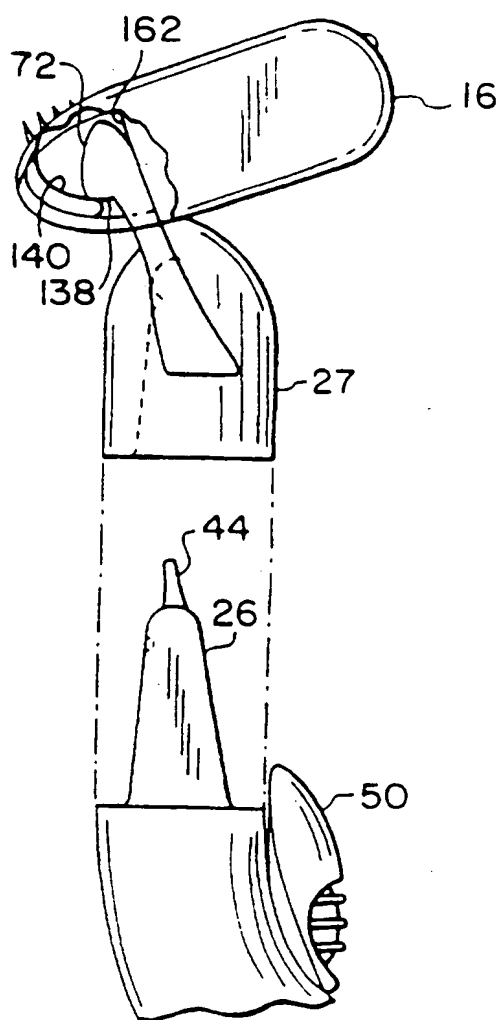
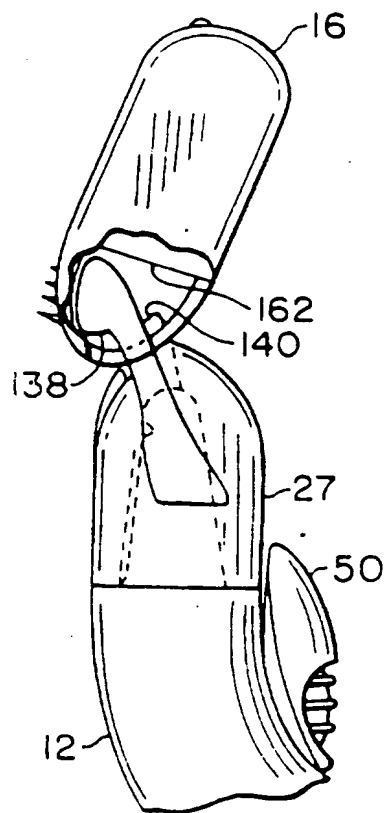
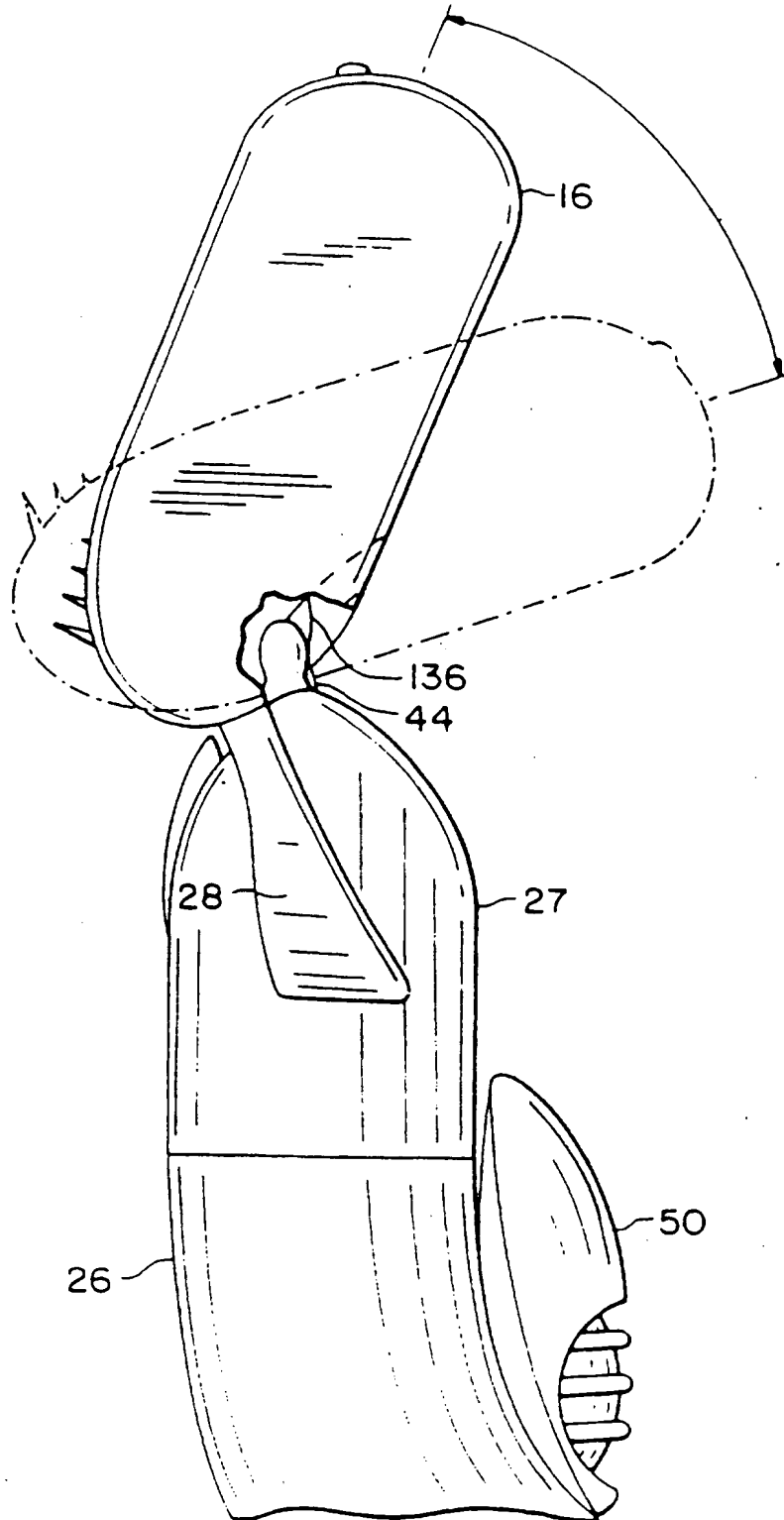


FIG. 17



12 / 13  
FIG. 18



13 / 13

FIG. 19

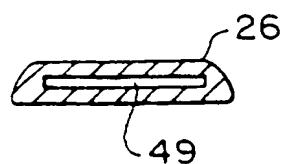


FIG. 20

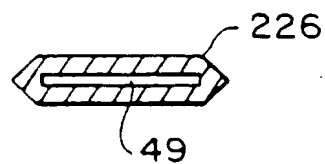


FIG. 21

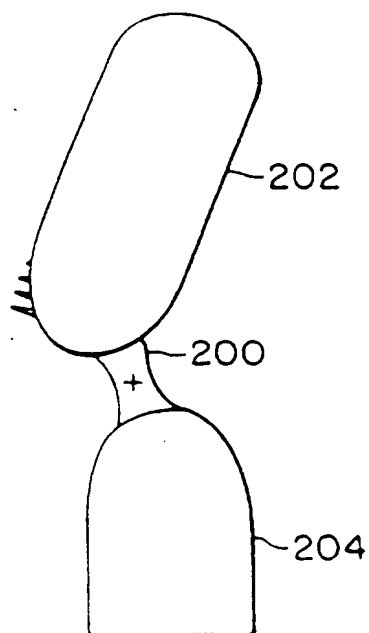


FIG. 22

